THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE AS FOLLOWS:

1. A method of calculating the flux of any gas(x) in a CBC circuit for a ventilated or a spontaneous breathing subject,

for example said gas(x) being;

a) an anesthetic such as but limited to;
   i) N_20;
   ii) sevoflurane;
   iii) isoflurane;
   iv) halothane;
   v) desflurame;

or the like

b) Oxygen;

c) Carbon dioxide;

or the like

utilizing the following relationships;

Flux of gas(x) $= SGF (F_{SX} - F_{EX})$

wherein

SGF = Source of gas flow into the breathing circuit (CBC circuit) in liters/minute as read from the gas flow meter as set by the anesthesiologist;

F_{SX} = Fractional concentration of gas X in the source gas (which is set by the anesthesiologist);

F_{EX} = Fractional concentration of gas X in the end expired gas as determined by a portable gas analyzer, or the like.

2. A method of calculating the flux of oxygen in a CBC circuit for a ventilated and/or spontaneous breathing subject utilizing the following relationship;

Flux of oxygen = SGF (F_{SO2} - F_{EO2})

wherein

SGF = Source of gas flow into the breathing circuit (CBC circuit) in liters/minute as read from the gas flow meter as set by the anesthesiologist;

F_{SX} = Fractional concentration of gas O_2 in the source gas (which is set by the anesthesiologist);

F_{EX} = Fractional concentration of gas O_2 in the end expired gas as determined by a portable gas analyzer, or the like.

3. The method of claim 1 or 2 wherein the CBC circuit is selected from the group consisting of i) a circle circuit; ii) a Magill breathing circuit; iii) an isocapnia circuit, whether breathing or non-breathing (as taught by co-pending Fisher et al), or the like.

4. The method of claim 1 or 2 wherein the CBC circuit is an improved Magill circuit as described herein.

5. The method of claim1 or 2 wherein the CBC circuit is an improved rebreathing circuit as described herein.

6. The method of claim 1 or 2 wherein the CBC circuit is an improved non-rebreathing circuit as described herein.

7. The method of claim 2 used to determine oxygen consumption in order to measure cardiac out put by any known method, such as the Fick method.

8. The method of claim 2 used to determine oxygen consumption in, for example, an operating room setting or the like.

9. The method of claim 2 or 8 used to optimize oxygen consumption.

10. The method of claim 2 or 8 utilized as an early indication of malignant hyperthermia.

11. A method of calculating the flux of any gas other than carbon dioxide, in a CBC circuit with low gas flow of source gas and with a carbon dioxide absorber in place utilizing the following relationship;

Flux of gas X = SGF (FEX - FRBX)

wherein

SGF = Source of gas flow into the breathing circuit (CBC circuit) in liters/minute as read from the gas flow meter as set by the anesthesiologist;

F_{EX} = Fractional concentration of gas X in the end expired gas as determined by a portable gas analyzer, or the like;

F_{RBX} = Concentration of gas X in the expired limb of circuit before the gas passes through the carbon dioxide absorber and mixes with gas coming from the flow meter.

12. The method of claim 11 used to determine the flux of an anesthetic for example:

i) $N_2 0$;

ii) sevoflurane;

iii) isoflurane;

iv) halothane;

v) desflurame,

or the like

13. The method of claim 12 used to determine how much anesthetic is being absorbed by the patient.

14. The method of claim 13 wherein said anesthetic is N_2O.

15. An improved Magill circuit the improvement comprising an inspiratory and expiratory limbs, a pressure relief valve at the end of the expiratory limb, a port for entry of SGF, and a gas reservoir bag, the components of the Magill system utilized for spontaneous ventilation; or alternatively for controlled ventilation, the gas reservoir bag is enclosed in a container with a port for connection to a ventilator breathing circuit, the pressure relief valve being enclosed in a container with a port for connection to a ventilator breathing circuit;

wherein on exhalation, the patient breathes out through the patient port and during the initial part of exhalation, the gas reservoir is partially empty and the resistance to flow along the inspiratory limb is less than that of the expiratory limb because the higher opening pressure of the pressure relief valve must be overcome before flow can proceed through the expiratory limb,

wherein during the initial part of expiration, the expired gas enters the inspiratory limb, displacing gas in the inspiratory limb and from the SGF into the gas reservoir, as the gas reservoir fills, the pressure in the circuit increases above the opening pressure of the pressure relief valve and the remainder of the expired gas is directed down the expired limb displacing the gas out of the expired limb through the pressure relief valve to the ventilator breathing circuit from where it is eventually vented to atmosphere through the expiratory port and the SGF continues to flow towards the patient down the inspiratory limb, displacing previously exhaled gas into the expiratory limb;

wherein during inhalation, the balloon valve occludes the ventilator circuit expiratory port and a volume of gas equal to a tidal volume is delivered by the ventilator into the ventilator circuit and hence into the SGF gas reservoir box, thereby displacing a volume equal to the tidal volume from the SGF gas reservoir into the inspiratory limb of the Magill circuit, the SGF continues to flow towards the patient down the inspiratory limb;

wherein the net tidal volume of the patient is equal to the volume displaced from the gas reservoir plus the SGF multiplied by the duration of inspiration, because the pressures on both sides of the Magill pressure relief valve are equal during inspiration, the differential pressure provided by the "opening pressure" of the valve keeps it closed during inspiration;

assuming that:

(1) the volume of the inspiratory limb is greater than or equal to [(SGF x expiratory time) + the anatomical dead space]; and the breathing bag volume is greater than [the largest expected tidal volume – (SGF x inspiratory time)],

(2) SGF is $\leq 0.7 \times \dot{V}_E$

16. An improved rebreathing isocapnia circuit comprising a Y piece with a patient port, and inspiratory limb of the Y piece with a one way inspiratory valve and an expiratory limb of the Y piece with a one way expiratory valve; the inspiratory limb being connected to a SGF and a gas reservoir, the expiratory limb leading to an expiratory gas reservoir, the expiratory gas reservoir having a one way valve at the port where expired gases are vented from the expired gas reservoir which allows gas to exit the expiratory gas reservoir but not enter, having disposed between the expiratory limb and the inspiratory limb distal to the inspiratory and expiratory valves a bypass limb that contains a one-way valve with an opening pressure of the valve, being for example approximately 1.5 cm H_2O, greater than the valves in the inspiratory limb of the Y piece and the expiratory limb of the Y piece; the direction of opening of the one-way valve in the bypass limb being from the expiratory limb to the inspiratory limb, the inspiratory and expiratory limbs being extended by tubing of variable lengths, the inspiratory and expiratory reservoirs being enclosed in a box with 3 ports; one port communicates with the box, one port communicates with the interior of the SGF reservoir only, one port communicates with the expiratory gas reservoir, the SGF reservoir is continuous with the inspiratory limb of the circuit, the expiratory gas reservoir is continuous with the expiratory limb of the circuit and has a port through which expired gas exits the expired gas reservoir and enters the box, a ventilator, a mushroom valve synchronized to occlude the ventilator circuit expiratory port during the inspiratory phase attached to the box ventilator port such that during the inspiratory phase, the tidal volume of the ventilator is discharged into the box , which will displace an equal volume from the gas reservoirs in the box; as the valve in the bypass limb has a greater opening pressure than the inspiratory valve, the inspiratory reservoir will be compressed in preference to the expiratory reservoir, when the inspiratory reservoir is collapsed, the remainder of the tidal volume will result from compression of the expiratory reservoir and displacement of gas through the bypass limb and valve and inspiratory valve to the patient, the total tidal volume will be equal to the volume

displaced from the inspiratory reservoir plus the volume displaced from the expiratory reservoir plus the SGF multiplied by the time during inspiration; during exhalation, the balloon valve is deflated, opening the expiratory port of the ventilator circuit to atmosphere and the expiratory reservoir bag to atmosphere via the port, thus allowing exhaled gas to flow past the expiratory one-way valve down the expiratory limb into the expiratory reservoir, SGF flowing into the port being directed down the inspiratory limb to the SGF reservoir, wherein gas is displaced in the box by expansion of the SGF reservoir and the expiratory gas reservoir is displaced from the box via the ventilator expiratory port; wherein SGF is less than or equal to $\dot{V}_E$ - $\dot{V}_{Dan}$.

17. An improved non-rebreathing circuit, the improvement comprising a balloon valve circuit for spontaneous ventilation of a patient breathing spontaneously, said circuit having a Y piece with a patient port, an inspiratory limb including a balloon valve, connected to SGF and a gas reservoir, an expiratory limb consisting of a balloon valve leading to an expiratory gas reservoir, which has a port opening to the atmosphere, a tank of compressed air flows through solenoid valves to open or close the balloon valves, the solenoid valves being controlled electronically by a computer, a pressure transducer connected to a mouthpiece for measuring when the fresh gas reservoir has been fully collapsed, the computer for receiving the signal and sending a signal to the solenoid valve to close the inspiratory valve and open the expiratory valve, the fresh gas flow continuously filling the fresh gas reservoir.

18. The method of claims 1, 2, or 11 used to calculate the rate of elimination of a gas X for any input total gas flow utilizing the following further relationships;

wherein the rate of elimination of gas X = the input total gas flow (multiplied by) F_{EX} - FI_X;

wherein F_{EX} is defined above and F_{IS} is the concentration of X in inspired gas.

19. The method of any previous claim wherein said method is incorporated in an algorithm spreadsheet, formula or the like contained within software which is capable of running on a computing device, or is installed therein.